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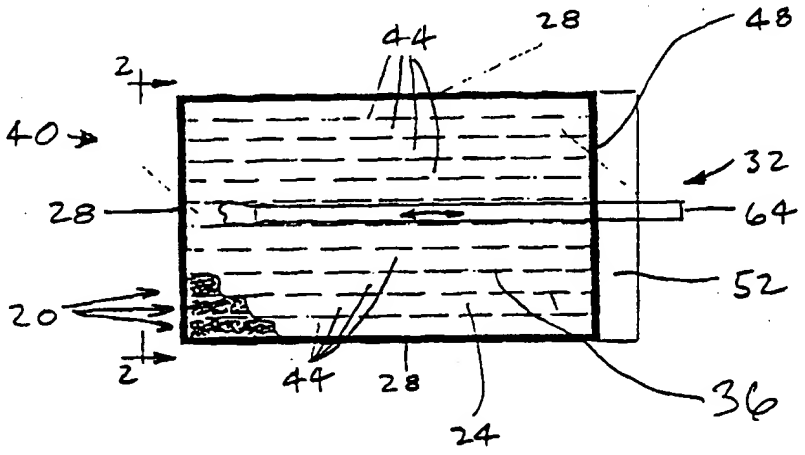

(57) Abstract

A deodorizer includes a raw mineral capable of removing an odor from air, the raw mineral formed into pellets (20). A method for making the deodorizer includes conditioning the raw mineral into a wet paste, forming the paste into the pellets (20), and drying the pellets (20). The pellets (20) are then placed in a spunbonded polypropylene bag (24). The bag (24) is placed in a housing (68) having a pair of opposed surfaces (76). Each of the opposed surfaces (76) has a number of openings (80) formed in it to promote the flow of air around the pellets (20).

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IMPROVEMENTS IN REFRIGERATION

Field of the Invention

This invention relates to methods and apparatus for improving the quality, for example, the shelf life, of material which is subjected to refrigeration.

Background of the Invention

While generally refrigeration has increased the life of perishables, refrigeration also contributes in some ways to the ultimate spoilage of perishables. As air is cooled, it loses its ability to dissolve water. As a result, the humidity inside a refrigerator, while it may be high in a relative sense, is low in an absolute sense. As a result, the air inside a refrigerator is relatively dry. As a consequence, perishables kept in the refrigerator tend to lose moisture to the refrigerator, becoming more and more desiccated with time in storage until, frequently, they are rendered inedible. An example is what happens to lettuce when left in a refrigerator over a long time. The moisture content of the lettuce gets lower and lower until the leaves lose their crispness and become unappetizing.

Another problem with refrigeration is that odors associated with whatever is in the refrigerator are generally captured in the refrigerator and absorbed by whatever else is in the refrigerator. Consequently, odors associated with one item in the refrigerator end up being absorbed by other items in the refrigerator which are absorbent. This phenomenon can also render the contents of the refrigerator unappetizing.

It has been known for some time to place substances in refrigerators to address problems associated with refrigeration. For example, baking soda is often placed in home refrigerators because of its ability to absorb odors from the air in the refrigerator. Odor absorbed by the baking soda is odor that is not available for absorption by the other contents of the refrigerator. As another example, a mineral mined from the Alan # 1 Diatomaceous Earth Mine, CACA 36311 and characterized by having the following elements in the following relative proportions: Si:20; Fe:2; Al:6; Mg:1; K:4; Ca:1; and Na:4, has been found effective in addressing both the desiccation problem and the odor problem in commercial walk-in refrigerators, and the

like. This mineral has been sold in furnace filter-like, flow through packages which are suspended from the ceilings of, for example, walk-in refrigerators.

These packages, or panels, have been demonstrated to remove odor from the air in the refrigerator. In addition, these panels have been demonstrated to stabilize the humidity inside the refrigerator. Both of these effects are believed to be salutary to increased life of perishables stored in the refrigerator. However, certain problems were encountered in the use of the mineral in the relatively raw state in which it came from the mine. For example, the raw mineral is quite dusty. This problem was treated by bagging the mineral in relatively low airflow rate bags. But, these low airflow rate bags restricted the ability of the mineral to balance and improve the environment inside the refrigerator.

Disclosure of the Invention

According to a first aspect of the invention, a method for making a deodorizer includes conditioning a raw mineral which, when processed is capable of removing an odor from air, into a wet paste, forming the paste into pellets, and drying the pellets.

Illustratively according to this aspect of the invention, conditioning the raw mineral into a wet paste includes adding water to the raw mineral.

Further illustratively according to this aspect of the invention, adding water to the raw mineral includes adding water to the raw mineral to a total moisture of between about 10% and about 25% by weight.

Additionally illustratively according to this aspect of the invention, forming the paste into pellets includes forming the paste into pellets in a pellet mill.

Further illustratively according to this aspect, the invention includes placing the pellets into an air-permeable container.

Further illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes placing the pellets in an air-permeable bag.

Additionally illustratively according to this aspect of the invention, placing the pellets into an air-permeable bag includes placing the pellets into a bag

divided into elongated cells, each defining a volume for retaining fewer than all of the pellets in the bag.

Illustratively according to this aspect of the invention, placing the pellets into a bag divided into elongated cells includes placing the pellets into a bag divided into a plurality of elongated cells in side-by-side orientation, long sides adjacent each other.

Further illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes placing the pellets into a spun-bonded bag.

Additionally illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes placing the pellets in a spun-bonded polypropylene bag.

Illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes placing the pellets into a housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air through the pellets.

Further illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes otherwise treating the housing to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, around the pellets, and then through the other of the opposed surfaces.

Additionally illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes placing the pellets into an air-permeable bag and placing the air-permeable bag into a housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air through the air-permeable bag.

Illustratively according to this aspect of the invention, placing the pellets into an air-permeable container includes otherwise treating the housing to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, through the air-permeable bag, and then through the other of the opposed surfaces.

According to another aspect of the invention, a deodorizer includes a raw mineral capable of removing an odor from air, the raw mineral formed into pellets.

Illustratively according to this aspect of the invention, the apparatus including an air-permeable container for the pellets.

Further illustratively according to this aspect of the invention, the air-permeable container includes an air-permeable bag.

Additionally illustratively according to this aspect of the invention, the air-permeable bag includes a bag divided into elongated cells, each defining a volume for retaining fewer than all of the pellets in the bag.

Illustratively according to this aspect of the invention, the bag divided into elongated cells includes a bag divided into a plurality of elongated cells in side-by-side orientation, long sides adjacent each other.

Further illustratively according to this aspect of the invention, the air-permeable container includes a spun-bonded bag.

Additionally illustratively according to this aspect of the invention, the spun-bonded bag includes a spun-bonded polypropylene bag.

Illustratively according to this aspect of the invention, the air-permeable container includes a housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air past the pellets.

Further illustratively according to this aspect of the invention, the housing includes a housing treated to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, around the pellets, and then through the other of the opposed surfaces.

Additionally illustratively according to this aspect of the invention, the air-permeable container includes an air-permeable bag and a housing for housing the air-permeable bag, the housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air through the air-permeable bag.

Illustratively according to this aspect of the invention, the housing includes a housing otherwise treated to minimize the flow of air around the outside of

the housing, thereby promoting the flow of air through one of the opposed surfaces, through the air-permeable bag, and then through the other of the opposed surfaces.

Brief Description of the Drawings

The invention may best be understood by referring to the following detailed description and accompanying drawings which illustrate the invention. In the drawings:

Fig. 1 illustrates a top or bottom plan view of a component of a system constructed according to the invention;

Fig. 2 illustrates an end view of the component illustrated in Fig. 1, taken generally along lines 2-2 of Fig. 1;

Fig. 3 illustrates an end elevational view of certain components of a system constructed according to the invention in assembled configuration;

Fig. 4 illustrates a top plan view of a component of a system constructed according to the invention; and,

Fig. 5 illustrates an end elevational view of certain components of a system constructed according to the invention in assembled configuration.

Detailed Description of an Illustrative Embodiment

According to an illustrative embodiment of the invention, the dust problem with the raw mineral is dealt with by pelletizing the raw mineral. First, the raw mineral, which as supplied is dusty crumbs is conditioned into a wet paste. To do this, water is added to the raw mineral to, for example, about 16% to 17% total moisture. This mixture is then formed and compacted into the pellets 20. Illustratively, the pellets have diameters in the range of about one-tenth of an inch (about 2.5 mm) to about one-quarter of an inch (about 6.4 mm), for example, approximately 3/16 inch (about 4.8 mm) diameter. Illustratively, the pellets have lengths in the range of about one-eighth of an inch (about 3.2 mm) to about one-half inch (about 13 mm), for example, about 1/4 inch (about 6.4 mm) length. Pellets 20 can be formed using, for example, a California pellet mill. The effective length of the pelletizing die illustratively is about 1-1/4 inches (about 31.8 mm). The thus-formed

pellets 20 exhibit minimal loss of absorption rate as compared to the raw mineral. The pellets 20 are then dried.

Next, the pellets 20 are loaded into breathable bags 24 with very high airflow capability. An illustrative bag 24 is a polypropylene spun-bonded bag with a weight of about two ounces (about 56.7 g) per square yard (about .83 sq. meters). Illustrative lay-flat bag 24 dimensions are about thirteen inches (about 33 cm) wide by about seventeen and a half inches (about 44.5 cm) long. An illustrative bag 24 is available from XPEDX, an International Paper company. It has heat sealed seams 28 on three sides. The fourth side 32 is open. Stitching 36, using, for example, a locking stitch, starts at a heat sealed end 40 of the bag 24. The illustrative bag 24 is divided by parallel stitching 36, which extends lengthwise of the bag 24, into parallel tube-like cells 44 for retaining relatively fixed volumes of the pellets 20. The parallel stitching 36 results in a somewhat "air mattress-" appearing construction, and keeps the pellets 20 from falling to the bottom of the bag 24 when the bag 24 is placed in the orientation in which the prior art furnace filter-style panels were oriented.

The stitching 36 illustratively is nylon thread. The rows of stitching 36 are spaced about an inch (about 2.5 cm) apart, so there are thirteen cells 44. The illustrative bag 24 is filled to within about two inches (about 5 cm) of the open end, or to the end of the stitching 36, and then heat sealed 48. The extra two and a half inches or so (about 6.4 cm) 52 of the bag 24's length are thus primarily for ease of handling and filling and sealing the bag 24. Two pounds of pellets 20 are loaded into the illustrative bag 24. The pellets 20, when loaded into the bag 24, are sufficiently large that they don't lie directly against the stitching 36. This enhances the availability of open areas within the bag 24 for the circulation of air into the bag 24, around the pellets 20, and out of the bag 24. The absorption rate of odors from the refrigerator, and the reaction time of the bag 24 to changes in humidity is enhanced by these construction details.

The bag 24 material and the stitching 36 create a system for holding the pellets 20 in place and permitting air to flow relatively easily into the bag 24, through the pellets 20, and out of the bag 24. The device 56 is an energy saving device because it works quickly to deodorize and humidify the air inside a refrigerator 60. Because the raw mineral was a dust, in the prior art devices, the mineral laid in the bag.

Pelletizing the mineral increased the available surface area. The illustrated bag 24 stabilizes the pellets 20, keeping them from wearing themselves down. The bag 24 is sufficiently porous that it permits the circulation through it of more air than the pellets 20 can deodorize and humidify. The pellets 20 can be placed in the bag 24, for example, by putting them in, for example, brass, tubes 64 slightly smaller than the cells 44 formed in the bag 24 by the stitching 36, and sliding the tubes 64 into the cells 44 formed in the bag 24 by the stitching 36, or by putting the tubes 64 into the cells 44 formed in the bag 24 by the stitching 36, then putting the pellets 20 into the tubes 64, and then pulling the tubes 64 out of the cells 44.

A housing for the bag 24 comprises an approximately twelve inch (about 30.5 cm) by approximately sixteen inch (about 40.6 cm) plastic box 68 with a galvanized steel frame 72. Each of the front and back twelve inch (about 30.5 cm) by sixteen inch (about 40.6 cm) sides 76 has roughly sixty to seventy approximately one inch (about 2.5 cm) diameter holes 80 in it. An expanded metal screen 84 having approximately one-eighth inch (about 3.2 mm) deep corrugations in it is placed against one of the twelve inch (about 30.5 cm) by sixteen inch (about 40.6 cm) sides 76. Then refrigeration-approved duct tape 88 is used to attach the metal screen 84 to the box 68 to seal against airflow around the outside of the bag 24. Then, the bag 24 goes into the box 68 on top of the metal screen 84. The bag 24 is taped, using so-called transfer tape 92, to the layer of refrigeration-approved duct tape 88 to seal it against airflow. Then the box 68 is folded and taped together. The box 68 includes a 24 gauge galvanized steel frame 72, resembling the frame of a reusable furnace filter, for protection and strength.

The box 68 may be suspended from the ceiling 96 of a commercial, walk-in refrigerator or cooler 60. This may be accomplished using an approximately two and a half inch (about 6.4 cm) tall, three sided, somewhat Z-shaped bracket 100. The bracket 100 includes an approximately 3/4 inch (about 19 mm) lip 104 all the way around the top of it with screw holes 108 in it to permit the bracket 100 to be attached by, for example, screws, to the cooler ceiling 96. The box 68 rests on an approximately 3/4 inch (about 19 mm) lip 112 that extends all the way around the bracket 100 and extends in the opposite direction from the top lip 104, that is, inward. The bracket 100 illustratively is about 12-1/8 inches (about 30.8 cm) deep by about

16-1/4 inches (about 41.3 cm) wide. It has been found that a distribution of one box 68 per approximately 150 cu. ft. (about 4249 liters) to approximately 200 cu. ft. (about 5666 liters) provides adequate performance in a typical commercial, walk-in refrigerator or cooler 60.

CLAIMS:

1. A method for making a deodorizer including conditioning a raw mineral which, when processed is capable of removing an odor from air, into a wet paste, forming the paste into pellets, and drying the pellets.

2. The method of claim 1 wherein conditioning the raw mineral into a wet paste includes adding water to the raw mineral.

3. The method of claim 2 wherein adding water to the raw mineral includes adding water to the raw mineral to a total moisture of between about 10% and about 25% by weight.

4. The method of claim 1 wherein forming the paste into pellets includes forming the paste into pellets in a pellet mill.

5. The method of any preceding claim further including placing the pellets into an air-permeable container.

6. The method of claim 5 wherein placing the pellets into an air-permeable container includes placing the pellets in an air-permeable bag.

7. The method of claim 6 wherein placing the pellets into an air-permeable bag includes placing the pellets into a bag divided into elongated cells, each defining a volume for retaining fewer than all of the pellets in the bag.

8. The method of claim 7 wherein placing the pellets into a bag divided into elongated cells includes placing the pellets into a bag divided into a plurality of elongated cells in side-by-side orientation, long sides adjacent each other.

9. The method of claim 5 wherein placing the pellets into an air-permeable container includes placing the pellets into a spun-bonded bag.

10. The method of claim 9 wherein placing the pellets into an air-permeable container includes placing the pellets in a spun-bonded polypropylene bag.

11. The method of claim 5 wherein placing the pellets into an air-permeable container includes placing the pellets into a housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air past the pellets.

12. The method of claim 11 wherein placing the pellets into an air-permeable container includes otherwise treating the housing to minimize the flow of air

around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, around the pellets, and then through the other of the opposed surfaces.

13. The method of claim 6 wherein placing the pellets into an air-permeable container includes placing the pellets into an air-permeable bag and placing the air-permeable bag into a housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air through the air-permeable bag.

14. The method of claim 13 wherein placing the pellets into an air-permeable container includes otherwise treating the housing to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, through the air-permeable bag, and then through the other of the opposed surfaces.

15. A deodorizer including a raw mineral capable of removing an odor from air formed into pellets.

16. The apparatus of claim 15 including an air-permeable container for the pellets.

17. The apparatus of claim 16 wherein the air-permeable container includes an air-permeable bag.

18. The apparatus of claim 17 wherein the air-permeable bag includes a bag divided into elongated cells, each defining a volume for retaining fewer than all of the pellets in the bag.

19. The apparatus of claim 18 wherein the bag divided into elongated cells includes a bag divided into a plurality of elongated cells in side-by-side orientation, long sides adjacent each other.

20. The apparatus of claim 16 wherein the air-permeable container includes a spun-bonded bag.

21. The apparatus of claim 20 wherein the spun-bonded bag includes a spun-bonded polypropylene bag.

22. The apparatus of claim 16 wherein the air-permeable container includes a housing having a pair of opposed surfaces, each of the opposed surfaces

having a number of openings formed in it to promote the flow of air through the pellets.

23. The apparatus of claim 22 wherein the housing includes a housing treated to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, around the pellets, and then through the other of the opposed surfaces.

24. The apparatus of claim 17 wherein the air-permeable container includes an air-permeable bag and a housing for housing the air-permeable bag, the housing having a pair of opposed surfaces, each of the opposed surfaces having a number of openings formed in it to promote the flow of air through the air-permeable bag.

25. The apparatus of claim 24 wherein the housing includes a housing otherwise treated to minimize the flow of air around the outside of the housing, thereby promoting the flow of air through one of the opposed surfaces, through the air-permeable bag, and then through the other of the opposed surfaces.

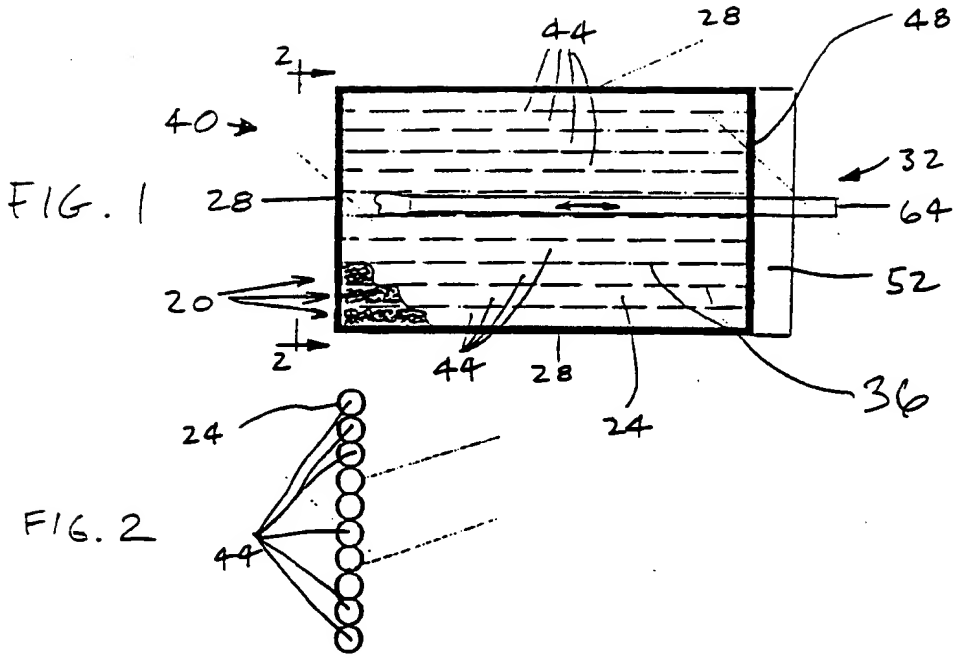


FIG. 1

FIG. 2

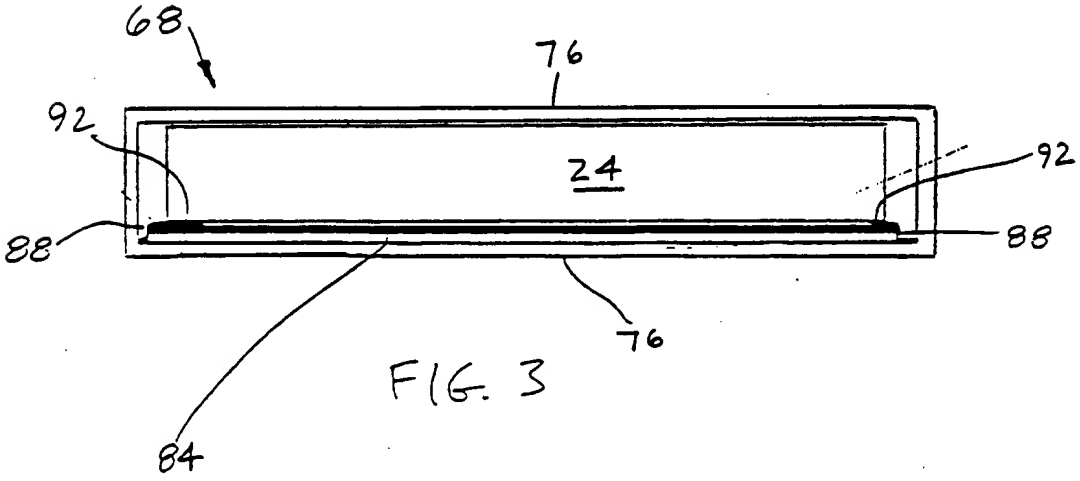
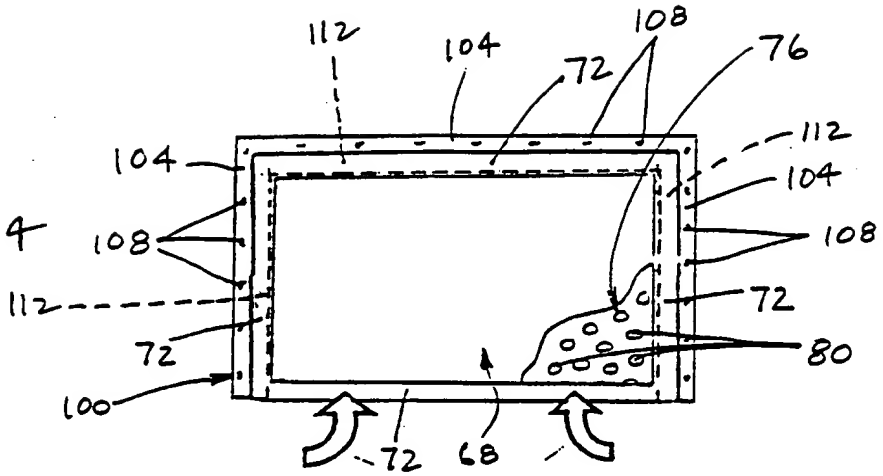


FIG. 3

FIG. 4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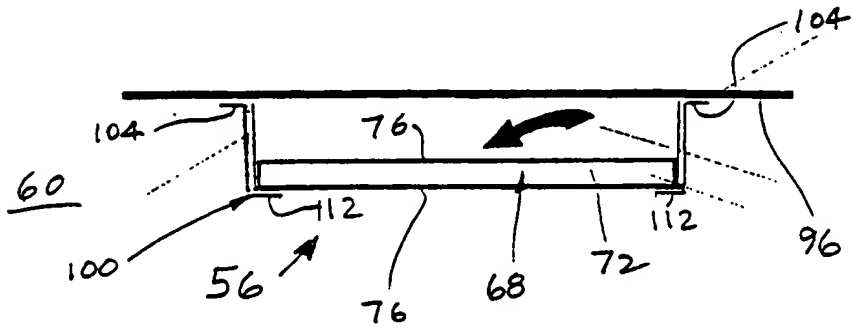
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FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/07648

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :B29C 67/02; B65B 1/04
US CL :264/117, 141; 53/452, 467; 428/35.2, 59
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 264/113, 117, 118, 140, 141, 142, 143; 53/452, 467, 477; 428/35.2, 59, 188

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

BRS
search terms: (air adj freshener) or deodorizer, pellet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 4,036,928 A (VALENTA) 19 July 1977, see entire document.	1, 2, 4, 15 ----- 3, 5-14, 16-25
Y	US 3,228,891 A (DUKE) 11 January 1966, see entire document.	1-25
Y	US 4,932,155 A (FRIEMEL et al) 12 June 1990, see entire document.	5-25
Y	US 4,340,402 A (CATRON) 20 July 1982, see entire document.	11-14, 22-25
A	US 5,804,264 A (BOWEN) 08 September 1998, col. 1, lines 60-67 and col. 2, lines 1-21.	5-25

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search	Date of mailing of the international search report
08 JUNE 2000	21 JUN 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DAE YOUNG LEE Telephone No. (703) 305-0393

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/07648

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,134,001 A (CSGOOD) 28 July 1992, see entire document.	6-11, 16-21